Mark Scheme 4725 January 2007

1.	(i) <i>a</i> = -3	B1	1	State correct value
	(ii) $2a - 3 = 7$ or $3a - 6 = 9$	M1		Sensible attempt at multiplication
	<i>a</i> = 5	A1	2	Obtain correct answer
			3	
2.		M1		Attempt to equate real and
				imaginary parts of $(x + iy)^2$ and 15
	$x^2 - y^2 = 15$ and $xy = 4$	A1 A1		+8i
		M1		Obtain each result
		DM1		Eliminate to obtain a quadratic in $x^2$
	$\pm$ (4 + i)	A1	6	or y <sup>2</sup>
			6	Solve to obtain $x = (\pm)4$ , or $y =$
				(±)1
				Obtain only correct two answers as complex numbers
3.		M1		Expand to obtain $r^3 - r$
		M1		Consider difference of two standard
	$\frac{1}{4}n^2(n+1)^2 - \frac{1}{2}n(n+1)$	A1		Obtain correct unfactorised answer
		M1		Attempt to factorise
		A1		Obtain factor of $\frac{1}{4}n(n+1)$
	$\frac{1}{4}n(n-1)(n+1)(n+2)$	A1	6	Obtain correct answer
			6	
4.	(i)	B1		Circle
		B1		Centre (1, -1)
		B1	3	Passing through (0, 0)
	(ii)	B1		Sketch a concentric circle
		B1		Inside (i) and touching axes
		B1	3	Shade between the circles
5.	(i)	B1	1	Show given answer correctly

	<ul> <li>(ii)</li> <li>-1±i√3</li> <li>(iii)</li> </ul>	M1 A1 B1 B1 B1	3 3 7	Attempt to solve quadratic equation or substitute $x + iy$ and equate real and imaginary parts Obtain answers as complex numbers Obtain correct answers, simplified Correct root on $x$ axis, co-ords. shown Other roots in 2 <sup>nd</sup> and 3 <sup>rd</sup> quadrants Correct lengths and angles or co- ordinates or complex numbers shown
6.	(i)	B1		Correct expression for $u_{n+1}$
		M1		Attempt to expand and simplify
	$u_{n+1}-u_n=2n+4$	A1	3	Obtain given answer correctly
	(ii)	B1		State $u_1 = 4$ (or $u_2 = 10$ ) and is divisible by 2
		M1		State induction hypothesis true for
		M1		$u_n$
		A1		Attempt to use result in (ii)
		A1	5	Correct conclusion reached for $u_{n+1}$
			8	Clear, explicit statement of induction conclusion
7.	(i) $\alpha + \beta = -5$ $\alpha\beta = 10$	B1 B1	2	State correct values
	(ii) $\alpha^2 + \beta^2 = 5$	M1		Use $(\alpha + \beta)^2 - 2\alpha\beta$
		A1	2	Obtain given answer correctly, using value of -5
	(iii)	B1		Product of roots = $1$
		M1		Attempt to find sum of roots
		A1		Obtain $\frac{5}{10}$ or equivalent
	$x^2 - \frac{1}{2}x + 1 = 0$	B1ft	4	Write down required quadratic
			8	equation, or any multiple.

8.	(i)	M1		Factor of $r!$ or $(r + 1)!$ seen
		A1		Factor of $(r + 1)$ found
	$(r+1)^2 r!$	A1	3	Obtain given answer correctly
	(ii)	M1		Express terms as differences using
		A1		(i)
		M1		At least 1 <sup>st</sup> two and last term correct
	(n+2)! - 2!	A1	4	Show that pairs of terms cancel
	(iii)	B1ft	1	Obtain correct answer in any form
			8	Convincing statement for non- converging, ft their (ii)
9.		M1		For at least two correct images
	(i) $\begin{pmatrix} 0\\0 \end{pmatrix}$ $\begin{pmatrix} 0\\-1 \end{pmatrix}$ $\begin{pmatrix} 3\\0 \end{pmatrix}$ $\begin{pmatrix} 3\\-1 \end{pmatrix}$	A1	2	For correct diagram, co-ords.clearly written down
	(ii) $90^0$ clockwise, centre origin	B1 B1		Or equivalent correct description
	$\left(\begin{array}{cc} 0 & 1 \\ -1 & 0 \end{array}\right)$	B1	3	Correct matrix, not in trig form
	(iii) Stretch parallel to x-axis, s.f. 3	B1 B1		Or equivalent correct description, but must be a stretch for 2 <sup>nd</sup> B1
			4	
		B1 B1		Each correct column
			9	

10.	(i)	M1		Show correct expansion process for
		M1		3 x 3
	$\Delta = \det \mathbf{D} = 3a - 6$	A1		Correct evaluation of any 2 x 2 det
		M1		Obtain correct answer
		A1		Show correct process for adjoint
		B1		entries
	$\mathbf{D}^{-1} = \frac{1}{\Delta} \begin{pmatrix} 3 & -2 & 4 \\ -3 & a & -2a \\ -3 & a & a & -6 \end{pmatrix}$	A1	7	Obtain at least 4 correct entries in
				adjoint
	(ii) $\frac{1}{4}$ $\begin{pmatrix} 5\\ 2z & 0 \end{pmatrix}$	M1		Divide by their determinant
	$\begin{pmatrix} a & b \\ a $	A1A1A1 ft all 3	4	Obtain completely correct answer
			11	
				Attempt product of form <b>D</b> <sup>-1</sup> <b>C</b> , or eliminate to get 2 equations and solve Obtain correct answers, ft their inverse